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EOS SAR: A New Approach

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The Mission

Earth Observing System Goals:

Develop the modeling and observational capabilities to predict and/or monitor atmospheric, terrestrial and oceanic processes that are either causing global change or resulting from global change

EOS SAR Goals:

To provide important geophysical products to the EOS data set to improve our understanding of the state and functioning of the Earth system

EOS SAR Strategy:

Define the instrument requirements based on required input to geophysical algorithms

Provide the processing capability and algorithms to generate such products on the required spatial (global) and temporal (3-5 days) scales

Provide the spaceborne instrumentation with international partnerships

- initially with Germany
- currently exploring broader international partnerships

Geophysical Properties

Ecology:

- Vegetation type
- Water status
- Biomass
- Seasonal state
- Fire extent

Hydrology:

- Soil moisture
- Snow moisture and extent
- Inundation extent
- Glacier zonation

Oceanography:

- Sea ice type and motion
- Wavelength and direction
- Currents and eddies

Geology:

- Landform distribution
- Surface roughness
- Subsurface structure and drainage

Progress in 1992

ERS-1 Polar Ice Results

- ERS-1/2 -> RADARSAT provide excellent data for polar ice community
- Polarimetric capabilities still required for thin ice type

Waring's SAR Vegetation Working Group (Ecological Applications)

- Current understanding of vegetation products from SAR
- Value in ecosystem models
- Freeze/thaw
- Biomass (<150 tons/ha)
- Inundation extent
- Water status

Engman's Hydrology Working Group and ISLSCP Workshop

- Soil moisture in root zone is the requirement
- Surface moisture measured by SAR may be related to soil moisture
- Algorithm independent of surface roughness developed (Ulaby)
- Shorter wavelength improves snow discrimination (Rott)

References

Operational Geophysical Products from SAR

<u>Product</u>	<u>Band Reqmt's</u>	<u>Temporal Reqmt's</u>
Current ASF for ERS-1:		
Sea ice motion	C-VV or C-HH	3 -day s
Sea ice type	C-VV or C-HH	3 -day s
Ocean wavelength and direction	C-VV or C-HH	weekly
JERS-1:		
Landform distribution	L-HH	once
Deforestation extent	L-HH	yearly
ASF Upgrade for RADARSAT/ERS-2:		
Glacier zonation	C-VV or C-HH	yearly
Freeze-thaw state	C-VV	< weekly
Fire extent	C-VV or C-HH	monthly
Inundation extent (tundra)	C-VV or C-HH	weekly
SIR-C/X-SAR Free Flyer:		
Vegetation type	L-quad, C-quad, X-VV	winter and summer
Regrowth biomass	L-quad	yearly
Surface roughness	L-quad, C-quad, X-VV	yearly
Subsurface structure/drainage	L-HH, high angle	once
EOS SAR:		
Soil moisture (and roughness)	L-quad	3 days, constant time of day
Snow moisture and extent	L-quad, C-quad, X	weekly, day-time
Vegetation water potential/moisture	L-quad, C-quad, X	diurnal
Thin ice type	L-quad	3 days
Inundation extent (forests)	L-HH	weekly

EOS SAR Mission Strategy: MultiSAR

Previous Strategy:

EOS SAR for all geophysical products:

L- and C-band from U.S.

X-band from Germany

Single platform

Mission start with EOS SAR launch

Potential International MultiSAR Strategy:

Obtain "baseline" global classification with SIR-C/X-SAR Free Flyer

- Geology products

- Vegetation type

- Regrowth biomass

Continue products started with ERS-1/2, JERS and RADARSAT

- Ice and ocean

- Glaciers

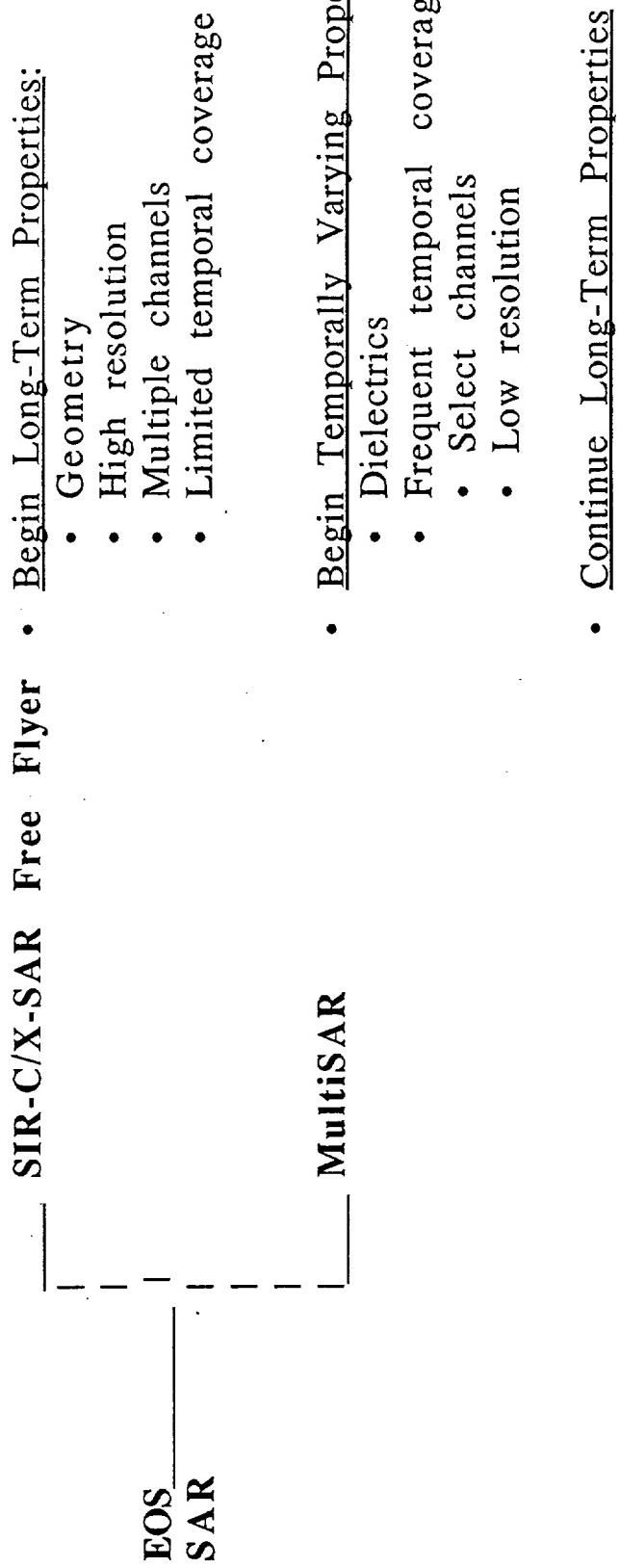
- Freeze/thaw, fire extent, inundation (tundra)

Design multiple spacecraft/SAR international mission series

- "hydrologic" properties

- change in "classification" properties

Split Concept for Global Data Products



Outstanding MultiSAR Requirements

- Outstanding relative to current international program and SIR-C/X-SAR Free Flyer

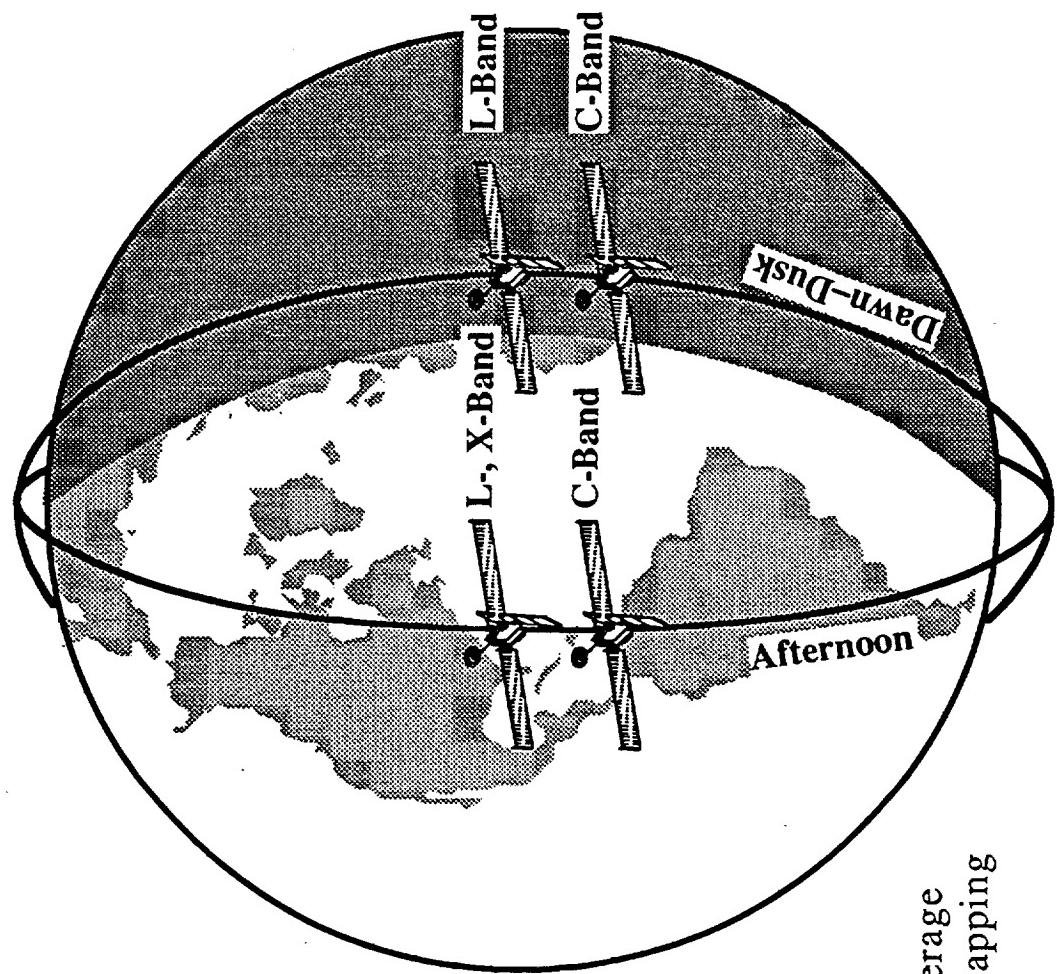
Data Products:

Product	Band	Reqm't	Temporal	Reqm't
Soil moisture (and roughness)	L-quad	X	3 days, constant time of day	
Snow moisture and extent	L-quad	X	weekly, day-time	
Vegetation water potential/moisture	L-quad, C-quad	X	diurnal	
Thin ice type	L-quad	X	3 days	
Inundation extent (forests)	L-quad		weekly	

New Requirements:

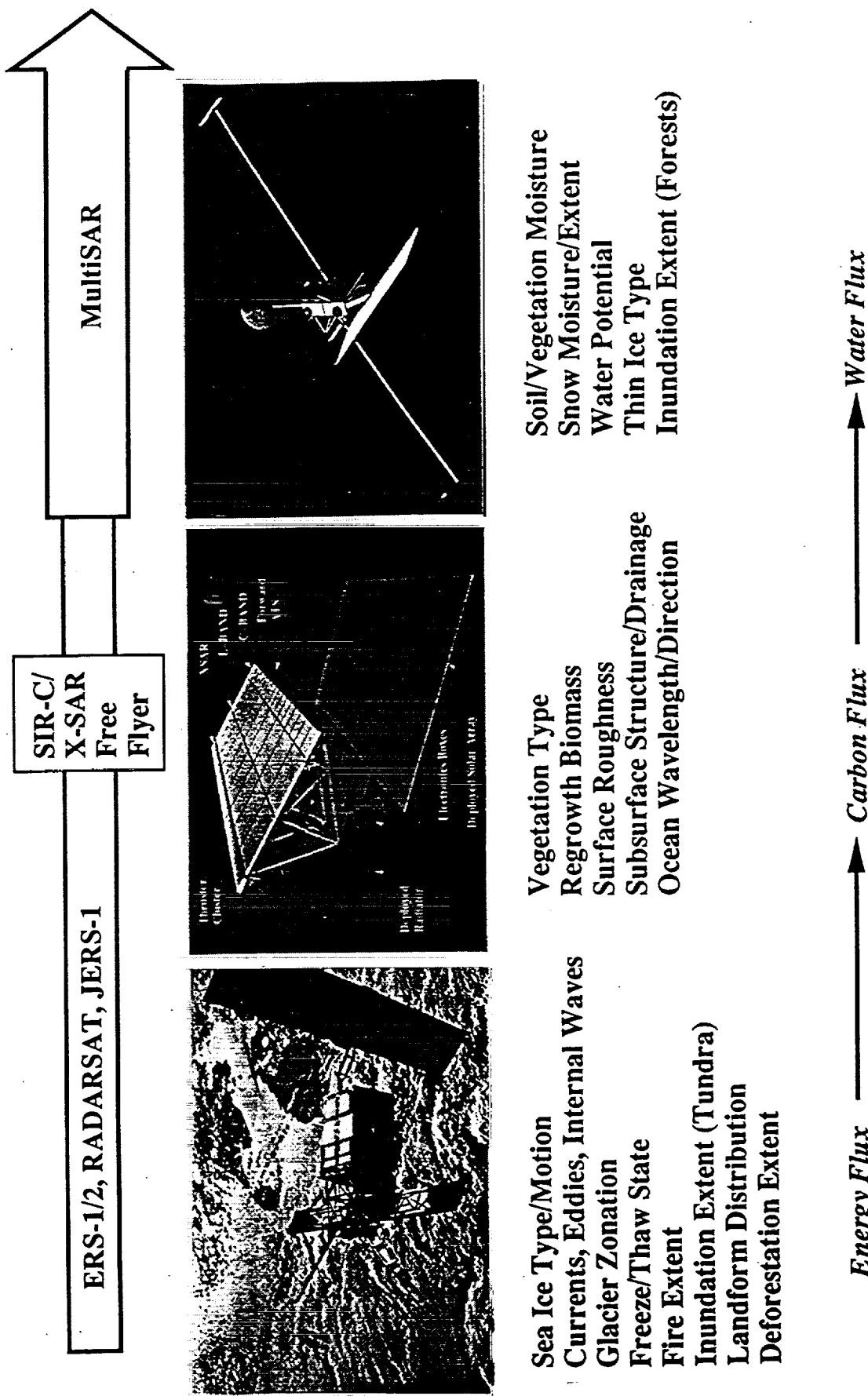
- Frequency/polarization:
Resolution:
Swath width:
Calibration:
Repeat coverage:
Equator crossing time:
Duty cycle:
- L-quad, C-quad, X
250 - 500 m (L, C), 30 m (X)
500 km (including quad)
<1dB relative lifetime
3-5 days
1:30 p.m., 1:30 a.m.; dawn, dusk
20-50%

Potential Synergism of International MultiSAR Mission



- diurnal coverage
- increased mapping

JPL Evolution of Geophysical Products Through Long-Term International Program



Conclusions

- Current international capabilities provide some temporally varying data products
- Multifrequency and multipolarization required for many products
- SIR-C/X-SAR Free Flyer provides initial look at long-term geophysical products
- Additional EOS SAR task is to add temporally varying water-related properties
 - must also continue long-term products
- International MultiSAR approach provides opportunity to optimize temporal multifrequency/pol. coverage of the globe

Next Steps

International agreement on science requirements

Series of discipline-oriented workshops and field campaigns

Mission scenario options for study

International approach to operational data product generation